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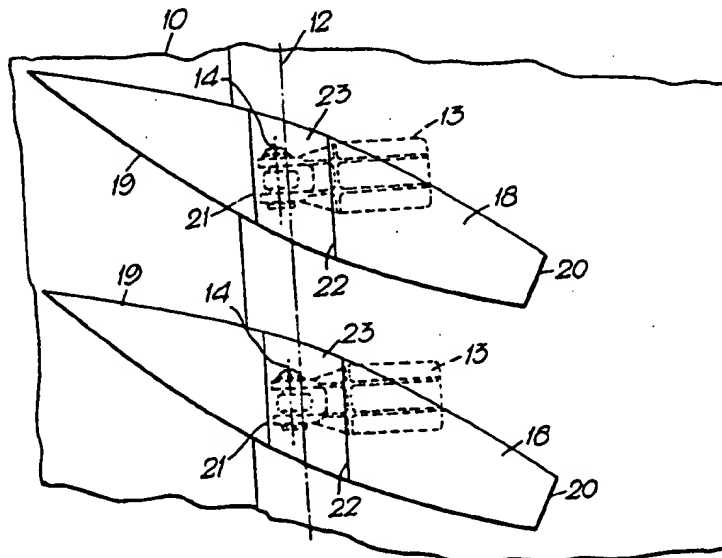
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(54) Fairing for aircraft control surface mounting

(57) An externally mounted fairing arrangement 18 for mounting upon and bridging an aircraft fixed structure 10 and a control surface 11, for example an aileron. In the particular embodiment described, the fairing encloses the hinges 14 by which the aileron is pivotally attached to the wing and an hydraulic jack (16) (Fig 1) by which means the aileron is actuated and which partially protrudes outside the wing/aileron profile. The fairing arrangement 18 includes a flexible seal portion 23 bridging the wing to allow for angular displacement of the aileron with respect to the wing whilst still maintaining acceptable fairing profiles, the seal being a labyrinth seal (Fig 4).

Fig. 2.



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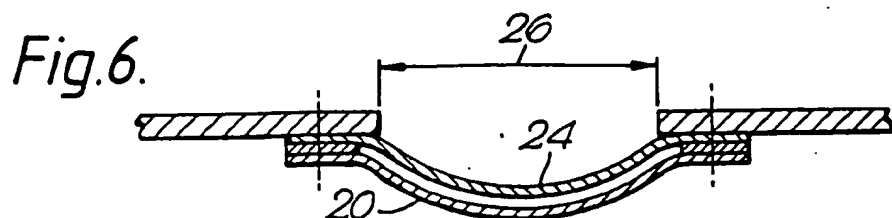
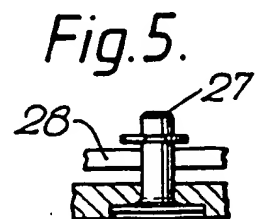
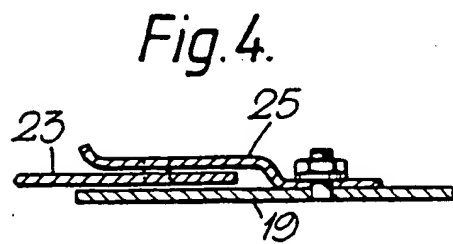
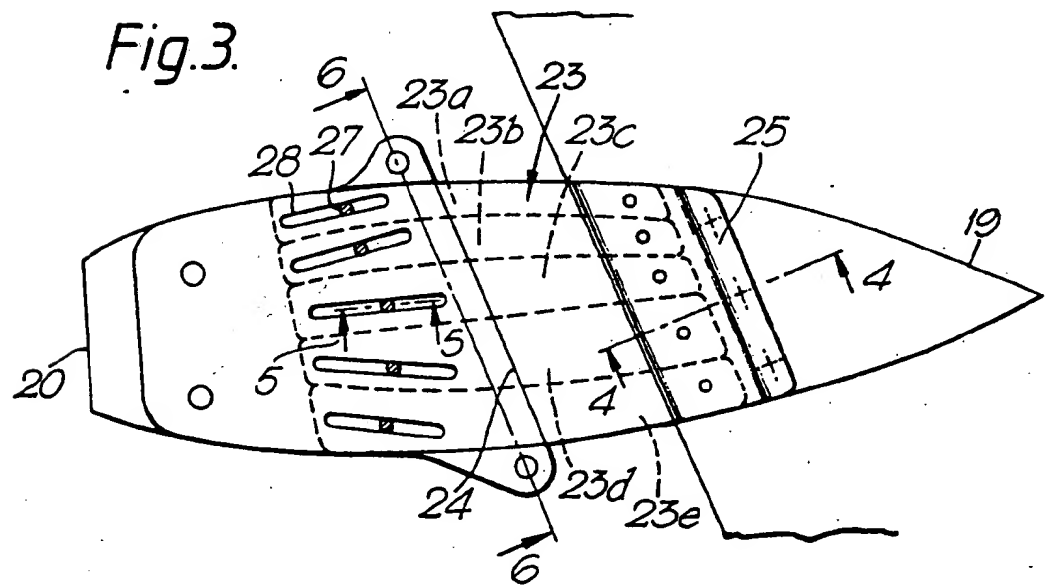
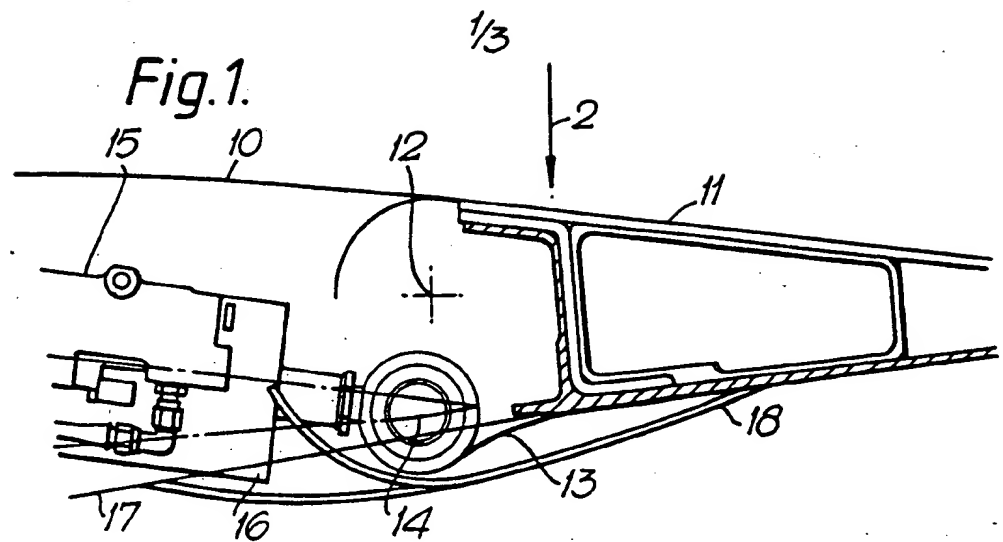
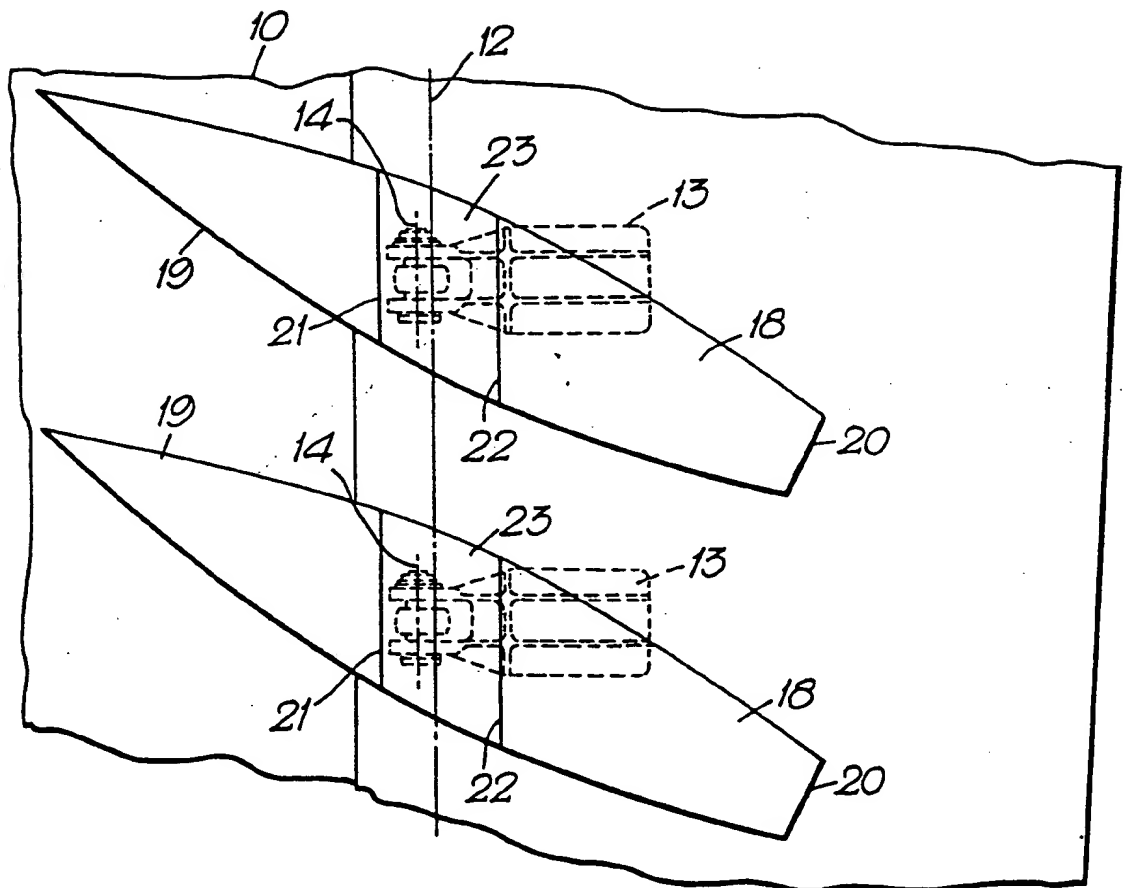


Fig. 2.



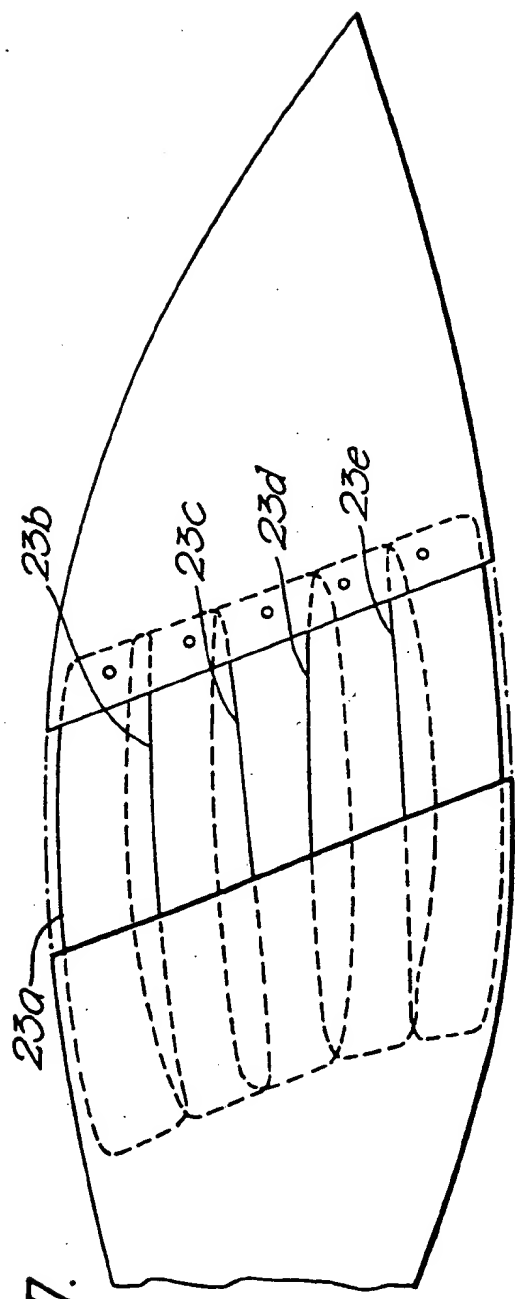


Fig. 7.

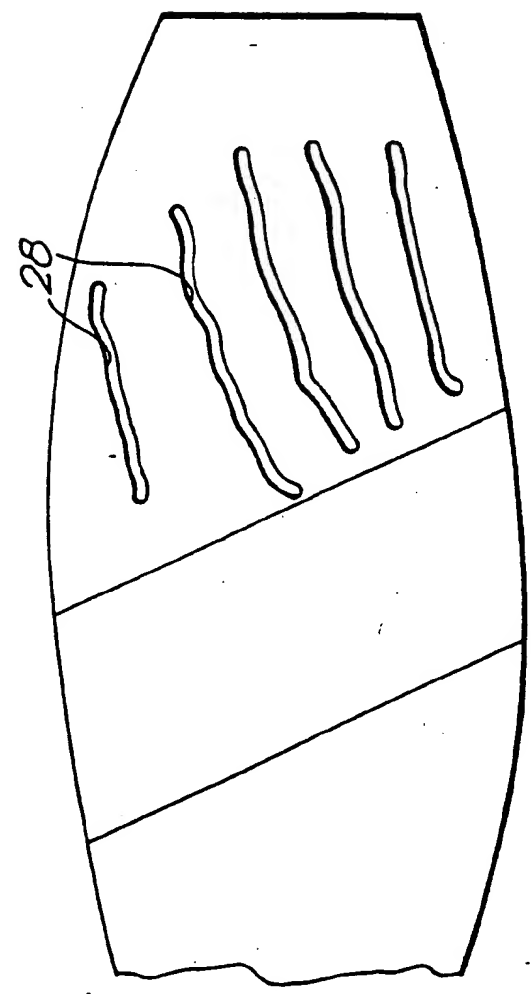


Fig. 8.

FAIRING ARRANGEMENTS FOR AIRCRAFT

This invention relates to fairing arrangements for aircraft. More particularly though not exclusively it relates to seal arrangements for use with externally mounted fairings associated with flying control surfaces, for example ailerons.

In the arrangement where an aileron, for example, is hingedly attached at the trailing edge region of the wing aileron actuating means such as an hydraulic jack, and duplicated for fail safe reasons, is pivotally located at its body end to the wing fixed structure and at its ram end to the fixed actuating lever at the aileron leading edge. For various reasons, for example the available volume within the wing structure or the need for readily accessibility, the installation may necessitate protrusion outside the wing lower profile. This in turn will necessitate an enclosing fairing which for good aerodynamic reasons of low drag will be of elongated form spanning the gap between the fixed wing trailing edge structure and the aileron. To allow for the angular deflection of the aileron however, at least that portion of the fairing bridging the said gap must be of some suitably flexible material and form but further complicated because ideally the fairing or fairings are positioned in line of flight whereas the aileron and the aileron actuating means are mounted about hinge lines which lie substantially parallel to the wing trailing edge which is swept back in

well known form. In operation, therefore, this will result in some at least slight differential lateral displacement between that part of the fairing fixedly mounted upon the wing and that mounted upon the aileron. This in turn, may lead to undesirable distortion of the flexible bridging portion. It is the object of the present invention to overcome this shortcoming by providing an improved arrangement of fairing incorporating an associated flexible seal assembly able to accommodate a wide range of angular displacement and differential movement.

According to the present invention there is provided an externally mounted fairing arrangement for mounting upon and bridging an aircraft fixed structure and control surface hingedly mounted upon and angularly displaceable with respect to said aircraft fixed structure, said fairing arrangement including a first fairing portion located upon said fixed aircraft structure, a second fairing portion located upon said control surface and an intermediate flexible seal portion interconnecting said first and second fairing portions, said flexible seal portion comprising a labyrinth seal assembly comprising two or more overlapping sealing elements configured such that in combination their cross-section conforms to the cross-sections of said first and second fairing portions but in operation can accommodate differential movement between said first and second fairing portions when said control surface is angularly displaced

relative to said aircraft fixed structure.

One embodiment of the invention will now be described by way of example only and with reference to the accompanying drawings in which:-

Figure 1 is a sectional side elevation through an aircraft wing/aileron interface.

Figure 2 is a view on that arrangement in direction of Arrow 2 in Figure 1.

Figure 3 is a plan view general arrangement of the fairing arrangement in accordance with the invention.

Figure 4 is a typical cross-section viewed along a line 4-4 in Figure 3.

Figure 5 is a sectional detail of a seal mounting spigot viewed along a line 5-5 in Figure 3.

Figure 6 is a typical cross-section through the fairing arrangement viewed taken along a line 6-6 in Figure 3.

Figure 7 is a plan view diagrammatic arrangement of the labyrinth seal assembly.

Figure 8 is a plan view illustrating programmed slots for labyrinth seal lateral movement.

Referring to the drawings Figure 1 illustrate a trailing edge portion 10 of an aircraft wing and a portion of aileron 11 hinge mounted at 12 to the wing by a hinge mounting bracket (not shown). A lever bracket 13 mounted on the forward face of the aileron provides a pivotal

attachment 14 for an hydraulic jack 16, the jack body 15 being pivotally attached (not shown) to the wing structure. The jack 16 and the bracket 13 protrude outside the bottom wing profile 17 and are enclosed within a fairing 18 as more clearly illustrated in Figure 2.

As shown in Figure 2, the aileron 11 has duplicated actuation, ie twin lever brackets 13 and jacks 16 and consequently, in this embodiment, twin streamline fairings 18. It would be possible but less preferable for reasons of drag to utilise a single all-encompassing fairing.

The fairings 18 are disposed upon the wing in line of flight, that is chordwise with respect to the aircraft longitudinal centre line whereas the aileron actuating means lie normal to the wing structure.

Each fairing 18 includes a forward fairing 19 and a rearward fairing 20 having cut lines 21 and 22 respectively and an interconnecting flexible labyrinth seal assembly 23.

A more detailed, though somewhat schematic, arrangement of the fairing assembly is shown by reference to Figures 3-6 inclusive. Figure 3, for clarity is drawn from the inside. Within the outer fairing 19 and 20 are respectively mounted a guide carrier 24 located to the aileron and a seal mounting carrier 25 mounted to the wing. The slot 26 shown is to accommodate the protrusion of the aileron actuating means.

The labyrinth seal 23 comprises five seal petals 23a, b, c, d and e, which are located at their rearward ends to the carrier 25, as shown in Figure 4 but adjacent their forward ends each petal includes spigots 27 which slidably engage lengthwise slots 28 in the guide carrier 24. These spigots are preferably moulded in position within each petal.

The labyrinth seals are more clearly illustrated in Figure 7 each of the petals 23a-d longitudinally overlapping its adjacent petal. The lengthwise slots 28 are more clearly illustrated in Figure 8 and although in Figure 3 these are shown as substantially straight they are in practice carefully tailored to allow controlled lateral displacement of the petals at different angular displacements of the aileron. The overlap and the configuration of the seal petals is also carefully designed to accommodate this lateral displacement and to ensure adequate seal at all times.

The petals are preferably made of pre-formed silicone rubber covered in PTFE or other low friction material and are stiffened with strip metal or some suitable non-metallic material. The seal elements may conveniently be bonded or sewn together. Other seal arrangements may be employed in place of the five-petal arrangement without in any way departing from the scope and spirit of the invention.

CLAIMS

1 An externally mounted fairing arrangement for mounting upon and bridging an aircraft fixed structure and a control surface hingedly mounted upon and angularly displaceable with respect to said aircraft fixed structure, said fairing arrangement including a first fairing portion located upon said fixed aircraft structure, a second fairing portion located upon said control surface and an intermediate flexible seal portion interconnecting said first and second fairing portions, said flexible sealing portion comprising a labyrinth seal assembly comprising two or more overlapping sealing elements configured such that in combination their cross-section substantially conforms to the cross-section of the said first and second fairing portions but, in operation, can accommodate differential movement between said first and second fairing portions when said control surface is angularly displaced relative to said aircraft fixed structure.

2 A fairing arrangement according to Claim 1 in which a seal mounting carrier is located within said first fairing portion and a guide carrier is mounted within said second fairing portion, said flexible sealing portion being fixedly attached at one end to said seal mounting carrier, and its opposite end slidable engaging said guide carrier.

3 A fairing arrangement according to Claim 1 or Claim 2 in which said guide carrier includes longitudinal guideway slots in alignment with each of said sealing elements, said sealing elements including a pin or spigot for engaging said guideway slots.

4 A fairing arrangement according to Claim 1 in which said sealing elements are formed from silicon rubber with low friction upper and lower surfaces.

5 A fairing arrangement according to Claim 4 in which said sealing elements are stiffened with integrally moulded metallic or non-metallic materials.

6 A fairing arrangement as substantially described herein with reference to the accompanying drawings.

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